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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/902,878	07/11/2001	Edward G. Combs	36080.00800	9162

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EXAMINER

CHAMBLISS, ALONZO

ART UNIT

PAPER NUMBER

2827

DATE MAILED: 11/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/902,878

Applicant(s)

COMBS ET AL.

Examiner

Alonzo Chambliss

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 October 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) 22-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 December 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4,7.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 1-21 in Paper No. 6 is acknowledged.

Claims 22-26 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected claims, there being no allowable generic or linking claim.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 7/11/01 in Paper No. 4 and 10/10/02 in Paper No. 7 was filed before the mailing date of the non-final rejection on 11/4/02 in Paper No. 8. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Drawings

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 116-1, 116-2, 116-3, 116-4, 202-1, 202-2, 202-3, and 202-4. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid

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abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

4. The abstract of the disclosure is objected to because the encapsulant material for encapsulating the thermally conductive element and the heat sink is not mentioned.

Correction is required. See MPEP § 608.01(b).

5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The following title is suggested: " ENHANCED THERMAL DISSIPATION INTEGRATED CIRCUIT PACKAGE ".

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

7. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

8. In claim 13, the phrase " interface element is in direct contact with said heat sink " is vague and indefinite, since the interface element is between the thermally conductive element and the semiconductor die. The thermally conductive is between the interface element and the heat sink.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1, 2, 4, 6, and 10 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Zimmerman (U.S. 5,172,213).

With respect to Claims 1 and 10, Zimmerman teaches a semiconductor die 40 electrically connect to a substrate by leads 18 (see col. 5 lines 16-29 and 52-56). The heat sink 50 (i.e. post for receiving heat generated from the die) has a portion thereof exposed to the surrounding of the package (see col. 1 lines 63-68; Figs. 4 and 5). The thermally conductive element 42 thermally coupled with and interposed between both the semiconductor die 40 and the heat sink 50, wherein the thermally conductive element 42 does not directly contact the semiconductor die 40. An encapsulant material encapsulating the thermally conductive element 42 and the heat sink 50 such that the portion of the heat sink 50 is exposed to the surroundings of the package (see col. 6 lines 8-17; Fig. 5).

With respect to Claim 2, Zimmerman teaches the thermally conductive element 42 that is substantially shaped as a right rectangular solid (see Fig. 5).

With respect to Claim 4, Zimmerman teaches the thermally conductive element 42 made of alumina (see col. 6 lines 8-17).

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With respect to Claim 6, Zimmerman teaches an interface element 44 interposed between the thermally conductive element 42 and the semiconductor die 40 (see Fig. 3).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claim 1 above, and further in view of Long et al. (U.S. 5,175,612).

With respect to Claim 3, Zimmerman discloses a tope portion of the heat sink 50 exposed to the surroundings of the package. Zimmerman fails to disclose a top portion

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of the heat sink exposed to the surroundings of the package. However, Long discloses a top portion and a side portion of a heat sink 70 exposed to the surroundings of the package (see Fig. 2). Therefore, it would have been obvious to incorporate the heat sink with the device of Zimmerman, since the heat sink would provide increased surface area and irregular topography for adhering to the epoxy as taught by Long.

13. Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claims 1 and 6 above, and further in view of Ference et al. (U.S. 6,265,771).

With respect to Claims 5 and 7, Zimmerman fails to disclose the integrated circuit package that is a ball grid array integrated circuit package with interface element that is made of polymeric material between a die and a heat sink. However, Ference discloses an integrated circuit package 40 that is a ball grid array integrated circuit package with interface element 43 that is made of polymeric material between a die 12 and a heat sink 26 (see col. 2 lines 62-67; Fig. 4). Therefore, it would have been obvious to incorporate the polymeric material with the device of Zimmerman, since the polymeric material is reliable material for dissipating heat to the fins of the heat sink as taught by Ference.

14. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claim 1 above, and further in view of Daves et al. (U.S. 6,091,603).

With respect to claim 8 and 9, Zimmerman fails to disclose a distance between the die and the thermally conductive element is about 5 mils or less while the die is

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electrically connected to the substrate by direct chip attachment. However, Daves discloses a distance between the die 600 and the thermally conductive element 103 is 3 or 4 mils while the die 600 is electrically connected to the substrate 500 by direct chip attachment. (see col. 5 lines 8-12 and 35-42; Fig. 1). Therefore, it would have been obvious to incorporate a distance of 5 mils or less with the device of Zimmerman, since the distance would reduce the thermal path between the die 600 and the thermally conductive element as taught by Daves.

15. Claims 11-13, 15, 20, and 21, insofar as being definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) in view of Long et al. (U.S. 5,175,612).

With respect to Claims 11 and 21, Lai discloses a substrate 2 comprising an upper surface with an electrically conductive trace 22 formed thereon and a lower face with a plurality of solder balls 25 electrically connected thereto, wherein the trace 22 and at least one of the plurality of solder balls 25 are electrically connected (see col. 5 lines 16-37; Fig. 2). A semiconductor die 3 is mounted on the upper face of the substrate 3, wherein the semiconductor die 3 is electrically connected to the trace 22. The heat sink 4 has a top portion and a plurality of side portions. The thermally conductive element 5 thermally coupled to but not in direct contact with the semiconductor die 3, wherein the thermally conductive element 5 is substantially shaped as a right rectangular solid. The thermally conductive element 5 is interposed between the die 3 and the heat sink 4 and is attached to the heat sink 4 (col. 3 lines 22-30; Fig. 2). An encapsulant material 9 formed to encapsulate the upper face of the substrate 2, the die 3, the thermally

conductive element 5, and substantially all of the heat sink 4 except the top portion. Lai fails to disclose an encapsulant material encapsulating a heat sink except the top portion and the side portions. However, Long discloses a top portion and a side portion of a heat sink 70 exposed to the surroundings of the package (see Fig. 2). Therefore, it would have been obvious to incorporate the heat sink with the device of Zimmerman, since the heat sink would provide increased surface area and irregular topography for adhering to the epoxy as taught by Long.

With respect to Claim 12, Lai discloses an interface element 6 interposed between the thermally conductive element 5 and the semiconductor die 3 (see Figs. 1 and 2).

With respect to Claim 13, Lai discloses the interface element 6 in direct contact with the heat sink 4 (see Fig. 1).

With respect to claim 15, Lai discloses the die 3 mounted on the upper face of the substrate 2 by direct chip attachment (see Fig. 2).

With respect to Claim 20, Lai discloses an integrated circuit package 1 that is a ball grid array integrated circuit package (see Fig. 2).

16. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Ference et al. (U.S. 6,265,771).

With respect to Claims 5 and 7, Lai-Long both fail to disclose an interface element that is made of polymeric material between a die and a heat sink. However, Ference discloses an interface element 43 that is made of polymeric material between a

die 12 and a heat sink 26 (see col. 2 lines 62-67; Fig. 4). Therefore, it would have been obvious to incorporate the polymeric material with the device of Lai-Long, since the polymeric material is reliable material for dissipating heat to the fins of the heat sink as taught by Ference.

17. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Daves et al. (U.S. 6,091,603).

With respect to claim 16, Lai-Long both fails to disclose a distance between the die and the thermally conductive element is about 5 mils or less while the die is electrically connected to the substrate by direct chip attachment. However, Daves discloses a distance between the die 600 and the thermally conductive element 103 is 3 or 4 mils while the die 600 is electrically connected to the substrate 500 by direct chip attachment. (see col. 5 lines 8-12 and 35-42; Fig. 1). Therefore, it would have been obvious to incorporate a distance of 5 mils or less with the device of Lai-Long, since the distance would reduce the thermal path between the die 600 and the thermally conductive element as taught by Daves.

18. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Zimmerman et al. (U.S. 5,172,213).

With respect to Claim 17, Lai-long both fail to disclose the thermally conductive element made of alumina. However, Zimmerman discloses a thermally conductive element 42 made of alumina (see col. 6 lines 8-17). Therefore, it would have been

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obvious to incorporate the thermally conductive element made of alumina with the device of Lai-Long, since the thermally conductive element made of alumina would increase the thermal performance of the molded package as taught by Zimmerman.

19. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Shin et al. (U.S. 5,854,511).

With respect to Claim 18 and 19, Lai-Long both fail to disclose the top portion of the heat sink with plating made of nickel. However, Shin discloses the top portion (i.e. the portion of the heat sink that is expose from the package) of the heat sink 20 with plating made of nickel (see col. 2 lines 47-56 and col. 5 lines 46-54). Therefore, it would have been obvious to substitute the heat sink with the plated nickel layer with the device of Lai-Long, since the plated nickel layer would create an easily ground and power bonding area on the heat sink as taught by Shin.

The prior art made of record and not relied upon is cited primarily to show the product of the instant invention.

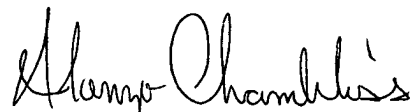
Conclusion

16. Any inquiry concerning the communication or earlier communications from the examiner should be directed to Alonzo Chambliss whose telephone number is (703) 306-9143. The fax phone number for this Group is (703) 308-7722 or 7724.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-7956.

AC/November 4, 2002



Alonzo Chambliss
Examiner
Art Unit 2827